CONTRIBUTIONS TO THE HISTORY OF THE DEVELOPMENT OF THE PYRENOMYCETES.

(Plate XIII.)

By Franz von Tavel.

(*Continued from page* 123.)

IV.—Cucurbitaria Platani, *n. s.*

Among the numerous fungi which came under our observation during this investigation, we gave special attention to a *Cucurbitaria*. It was found only on the fallen *Platanus* branches and then sparingly, so that our investigations were necessarily limited to the formation of the pycnidia. For the same reason it was impossible to identify the fungus. It is here designated as *Cucurbitaria platani* n. s., because from a purely practical stand-point the object of an investigation must have a name, and because neither Saccardo nor Winter mention a *Cucurbitaria* growing upon *Platanus*.

The stroma of the fungus is circular and about 2 mm. in diameter. It lies under the bark, which becomes broken through by the perithecia and pycnidia. Generally several stromata stand close together. Twenty fruiting bodies, partly pycnidia and partly perithecia, stand in very irregular order upon a stroma. They are often very close to each other and frequently grow together. The pycnidia have very irregular cavities and thick, intensely black walls. The basidia are filiform, the pycnidia spores extraordinarily small, cylindrical, and colorless. The perithecia are flask-shaped but of very irregular form and without a distinct neck or papilla. Their walls are also black and scarcely project beyond the bark. The asci are 8-spored, cylindrical, obtuse above and suddenly tapering into a short pedicel below.

The spores are light brown at maturity, elliptical, a little smaller at the ends, and strongly constricted in the middle. They usually have six transverse septa, often more or less; the number of the longitudinal septa is very variable. They are 18–25 μ. long by 9–11 μ. broad (Fig. 13.)

The ascospores germinate rapidly even when they have been kept dry for a long time, but they behave very differently in water and in nutritive solutions. When sown in distilled water, sometimes all, and sometimes only single cells of the spore send out germ tubes which

grow rapidly for a long time. On account of the passage of the contents of the spore into the germ tube the former becomes much more transparent; its cells also swell up, but it shows no farther changes. The germ tube soon becomes divided up into short cells at its base. When the nutritive materials in the spore are used up the growth at the end ceases. The entire germ tube then divides up into roundish, much swollen cells, which produce gonidia-like buds.

The results are different when the sowings are made on gelatine which is mixed with a plum decoction, grape juice, or meat extract. The first phenomena of growth are the same. But the terminal growth of the germ tubes does not cease, and they consequently spread themselves over a relatively large area in a very short time. Their cells are therefore not short and thick but elongated, at first at least. In this case spores are not cut off.

The ascospore itself undergoes a considerable transformation. It swells up at first and becomes more transparent as happens when it is sown in water (Figs. 14–16). As the size increases new transverse septa and soon after longitudinal septa make their appearance. These septa become continually more numerous and consequently the whole spore increases in circumference; they appear in the greatest numbers in the central cells of the spore, while the ends change very little for some time. The primary cells may be visible for some time on account of the constrictions at the septa. In the manner described the spore is transformed into a large body easily visible to the naked eye and composed of a considerable number of very small cells, from which the germ tubes, which in the meantime have become large strong hyphæ, now project in different places. About six days after sowing it begins to turn brown and finally becomes so dark colored that further observations of special development are rendered impossible. It can only be seen that the cells composing the interior separate, leaving a cavity. After some time, during which the growth of the body has ceased, gonidia began to emerge from the opening in the apex. We have therefore a pycnidium situated in the center of a mycelium. A special pore which may be recognized by some especially large clear cells, is now started.

The formation of this pycnidium (it may be called a sporopycnidium in order to distinguish it from the others) does not occur when the spores are sown in distilled water; the germ tubes must therefore first grow at the expense of the spore and then take up nourishment from the substratum and carry it to the spore, in order to supply the consumption and furnish a surplus which makes it possible for it to attain such dimensions and pass through such transformations.

The sporopycnidium is a very interesting phenomenon for two reasons. In the first place it is known that by absorbing nutriment, a fungous spore may increase in dimensions and that its cells may divide De Bary (Morphol. u. Biol. d. Pilze, 1884, p. 123.) cites the *Mucorini* and

Sclerotineæ as examples of this. But such a luxuriant growth, connected with such a high degree of cell division, which simultaneously produces the growth of a mycelium from the spore, and changes the latter into a new and complicated organ of reproduction, can scarcely have been observed before.

But the case presents a further point of interest when compared with the formation of other pycnidia. We may discriminate between a symphyogenous and a meristogenous development. Pycnidia arise symphyogenously by an interweaving of hyphæ and meristogenously by the growth and division into cells of a piece of hypha in which the branches of the hypha may share. The sporopycnidium is therefore meristogenous even if it does not arise from a mycelial thread. It represents rather the most extreme case of meristogenous development, arising directly from the division and growth of the spore without the interposition of any foreign element.

Before the formation of this sporopycnidium is completed the beginnings of new pycnidia arise at the periphery of the mycelium. These are of meristogenous origin, yet several hyphæ are concerned in their construction. One or several cells swell up anywhere upon a hypha (Figs. 17–18), and these become divided by walls which are laid down both in transverse and longitudinal directions. In the vicinity of these spots the hyphæ which bound and those which accidentally cross or touch them exhibit the same changes, their cells also enlarging and dividing. In this way these hyphæ nearly fasten themselves to each other. Through continued growth and cell division there arises a many-celled compact body from which many hyphæ apparently originate; but it is from them that the body itself arose. The young pycnidia may attain considerable size without showing any cavity (Fig. 19). At first no differentiation can be seen until the walls of the superficial cells become thickened and brown. The single cells also increase in size with the growth of the whole, but the central portion finally falls behind the periphery, and the cells separate from each other in the center, without, however, as Bauke has shown for *Cucurbitaria elongata*, the process being begun by a very large definite cell. In this way there arises a cavity which enlarges with the growth of the pycnidium (Fig. 20) and is lined by uniform cells. From these grow out filiform basidia, which form a hymenium and cut off very small spores (Fig. 21). The outer wall of the pycnidium is now composed of cells whose contents have been transformed into a dark-colored mass, while the membranes themselves are less deeply colored. Here also are the beginnings of a special pore, as is the case in the sporopycnidium.

These pycnidia develop in essentially the same manner described by Bauke for *Cucurbitaria elongata;* but with this difference, that here the hyphæ which lie against the beginnings of the pycnidium do not merely form the envelope, but instead all the elements have the same functions, as is shown by cross-sections through quite young stages.

The further development of *Cucurbitaria platani* was not followed out. Secondary pycnidia began to develop on the slide in extraordinarily large numbers. The mycelium gradually became transformed into a stroma, the hyphæ continually growing darker, more closely interwoven and smaller celled. A stroma of this kind was placed with the pycnidia upon a fresh *Platanus* branch upon a place where the bark was injured. The stroma soon became completely covered with pycnidia. The peripheral hyphæ penetrated the bark, from which only a few pycnidia followed. After a long time perithecia could also be seen; but they were so few that any investigations were not to be thought of.

The ascospores of *Cucurbitaria platani* were sown upon another branch. It remained intact for a long time, but after it was apparently dead and had begun to decay pycnidia broke out upon the cut surfaces and leaf scars, in short, wherever the bark was injured. It may be concluded from this that *Cucurbitaria platani* is not a parasite but merely a saprophyte. Cultures upon leaves gave no reliable results.

MYCOLOGICAL NOTES.

By George Massee.

(Plate XIV.)

1. Tremella tremelloides, (Berk.) Mass. (Fig. 1). Tremelloid; lobes fasciculate, *elongated*, *suberect*, almost free to the base or variously united, *compressed*, springing from a small contracted base, *surface scabrid*, dull orange; spores elliptic-oblong with a minute oblique apiculus at the base, 11-12 by 5 μ.

Sparassis tremelloides, Berk., Grev. Vol. II, p. 6; Sacc. Syll., Vol. No. 7926.

On wood, Lower Carolina. (Type in Herb. Berk., Kew, No. 4088). Forming large tremelloid tufts, always springing from a very small basal portion, which penetrates the matrix; lobes suberect, 3–4 inches high in well grown specimens, sometimes smaller, in some specimens variously plicate and almost free to the base; in others the lobes are united laterally and form a gyrose tuft, always much compressed. The distinctly scabrid surface is very characteristic, and is due to thickly scattered papillæ, which give a very harsh feel to dry specimens. Basidia large, sterigmata developed in succession.

STELLA, Mass. (*nov. gen.*).

(Fig. 2.)

Peridium consisting of two distinct layers united at the base only; outer layer thick, splitting in a stellate manner from the apex, inner layer thin, indehiscent; gleba traversed by numerous anastomosing thin tramal plates, which are continuous with the inner wall; columella and capillitium absent; spores forming a powdery mass at maturity.

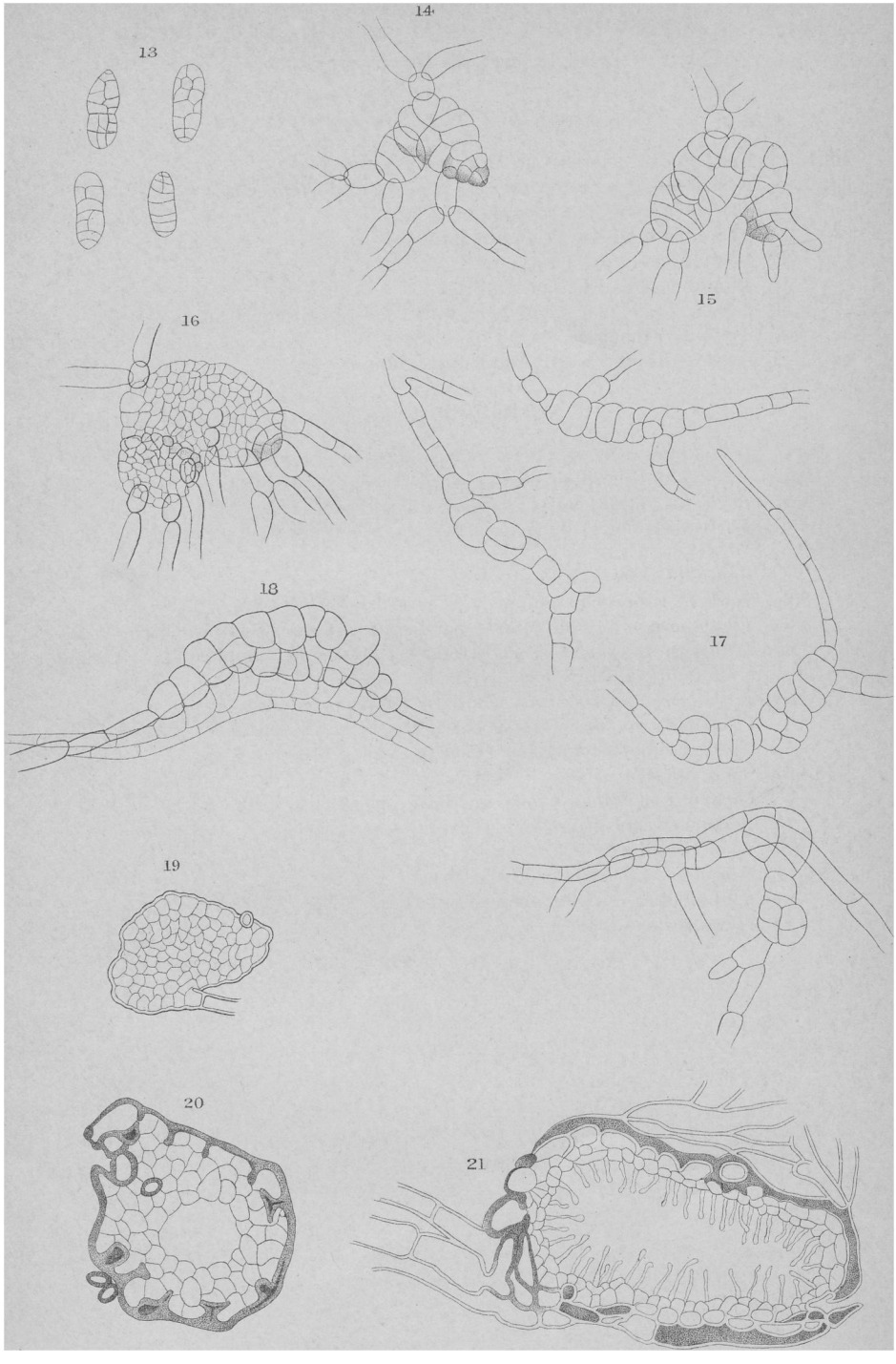
DESCRIPTION OF PLATES.

PLATE XIII (*after Von Tavel.*)

FIG. 13. *Cucurbitaria platani*, Von Tav.; ascospores × 380.
14. Formation of sporopycnidium; the spore three days after sowing. × 380.
15. The same spore five hours later × 380.
16. The same spore twenty hours later × 380.
17. Beginnings of pycnidia × 600.
18. A later stage of the same × 600.
19. Section through a young pycnidium, the cavity not yet formed × 700.
20. Section through an older pycnidium × 700.
21. Section through a fully-formed pycnidium × 700.

PLATE XIV (*G. Massee, del.*)

FIG. 1. *Tremella tremelloides*, (Berk.) Mass., portion of a plant, natural size.
1*a*. Basidia and spores of same × 400.
2. *Stella Americana*, Mass.; specimen natural size.
2*a*. Vertical section of same, natural size; (*a*) outer wall of peridium; (*b*) inner layer.
2*b*. Spores of same × 350.
2*c*. Spore of same, showing epispore, as seen when × 1,200.
3. *Trichosporium Curtisii*, Mass.; portion of a specimen natural size.
4. *Trichosporium phyrrhosporium*, (Berk.) Mass.; (*a*) conidia; (*b*) a condiophore detached from its hypha, all × 350.
5. *Trichosporium apiosporium*, (B. & Br.) Mass.; conidia × 350.
6. *Badhamia nodulosa*, (Cke. & Balf.) Mass.; entire specimens × 40.
6*a*. Portion of capillitium and spores of same × 350.
6*b*. Spore of same × 1200.
7. *Physarum scyphoides*, Cooke and Balf.; specimens × 40.
7*a*. Portion of capillitium and spores of same × 350.
7*b*. Spore of same × 1200.
8. *Tilmadoche gyrocephala*, Rost.; specimen × 40.
8*a*. Portion of capillitium and spores of same × 350.
8*b*. Spore of same × 1200.



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VON TAVEL ON DEVELOPMENT OF THE PYRENOMYCETES.

CUCURBITARIA PLATANI.